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Yamabata

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(54) **ELECTRONIC STRINGED INSTRUMENT HAVING EFFECT DEVICE**

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G10H 3/26 (2006.01)
G10H 3/18 (2006.01)

(52) **U.S. Cl.**
USPC **84/627**; 84/626; 84/663; 84/702; 84/738

(58) **Field of Classification Search**
USPC 84/626, 627, 663, 702, 738
See application file for complete search history.

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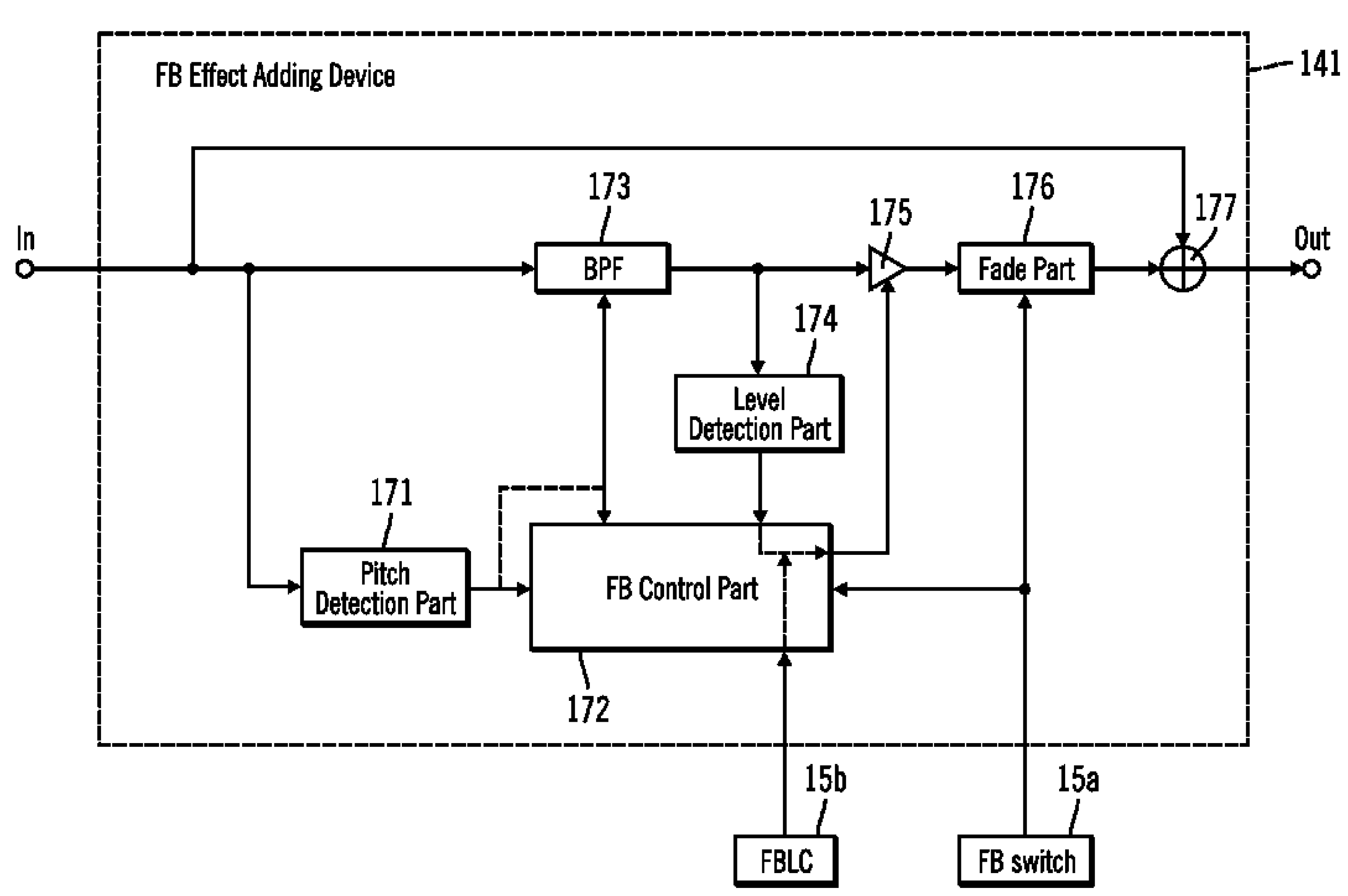
(57) **ABSTRACT**

Provided is an electronic stringed instrument comprising: a pickup that detects vibration of a string; a feedback operator used to select a level of feedback effect; a feedback control device that controls to add a feedback effect to a tone signal based on the vibration of the string detected by the string vibration detection device and based on the selected level of feedback effect from the feedback operator; and an output device that outputs the tone signal to which the feedback effect is added by the feedback control device.

21 Claims, 8 Drawing Sheets



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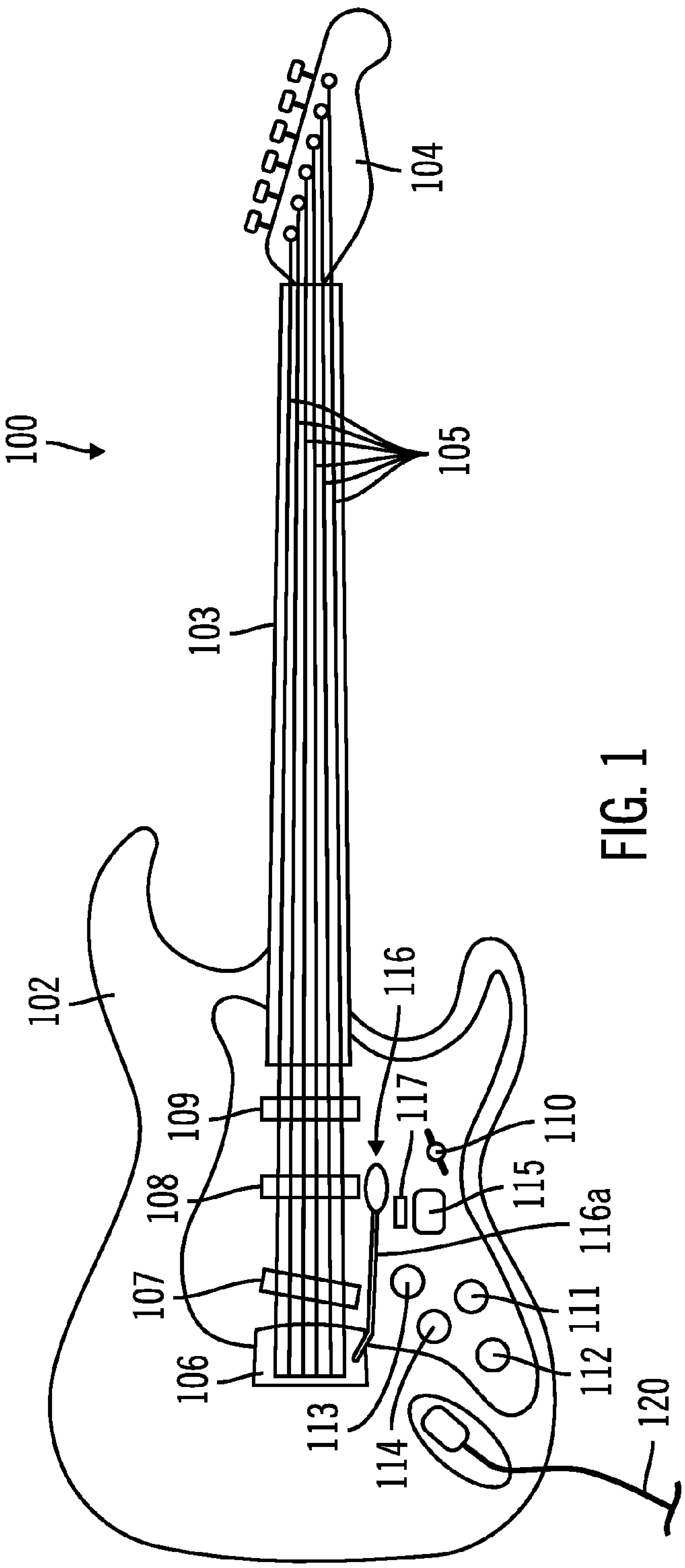
100
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
116a
117
120

FIG. 1

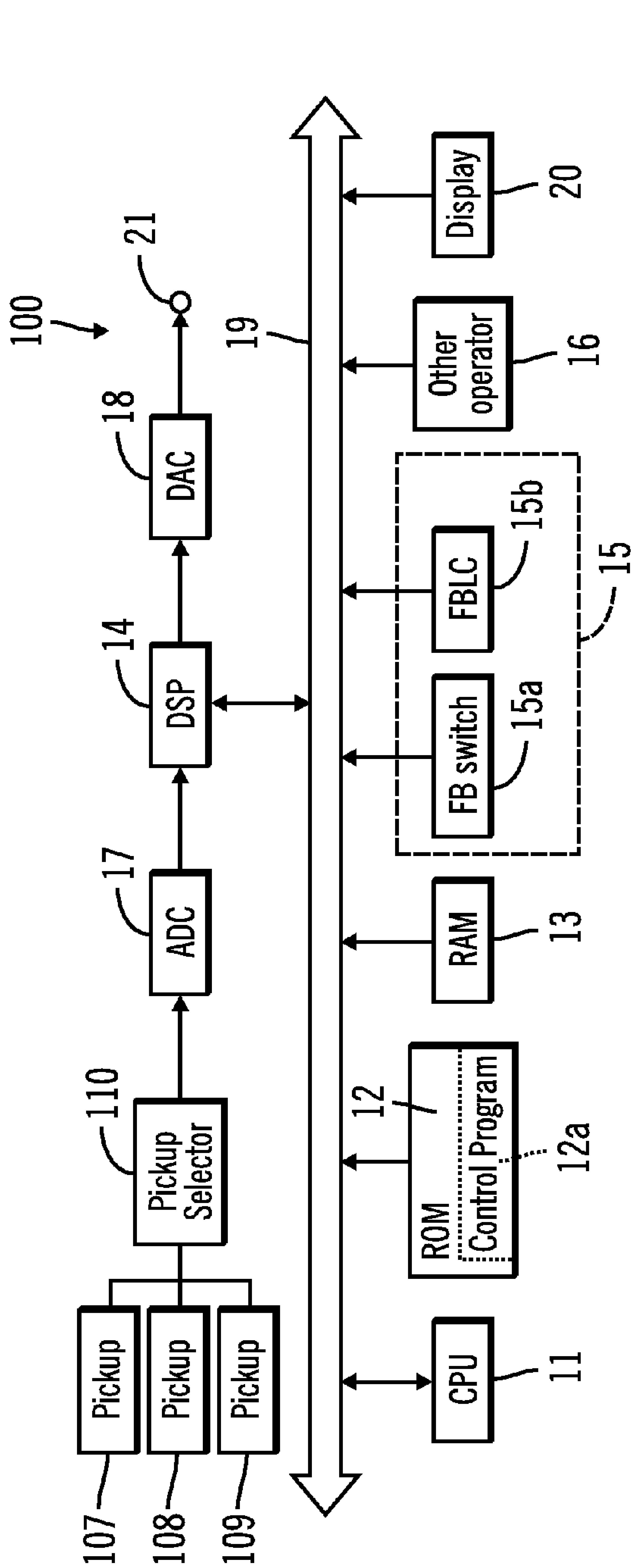
100
21
18
DAC
14
DSP
17
ADC
110
Pickup Selector
Pickup
Pickup
Pickup
107
108
109
19
Display
20
Other operator
16
FBLC
15b
FB switch
15a
15
RAM
13
ROM
Control Program
12
12a
CPU
11

FIG. 2A

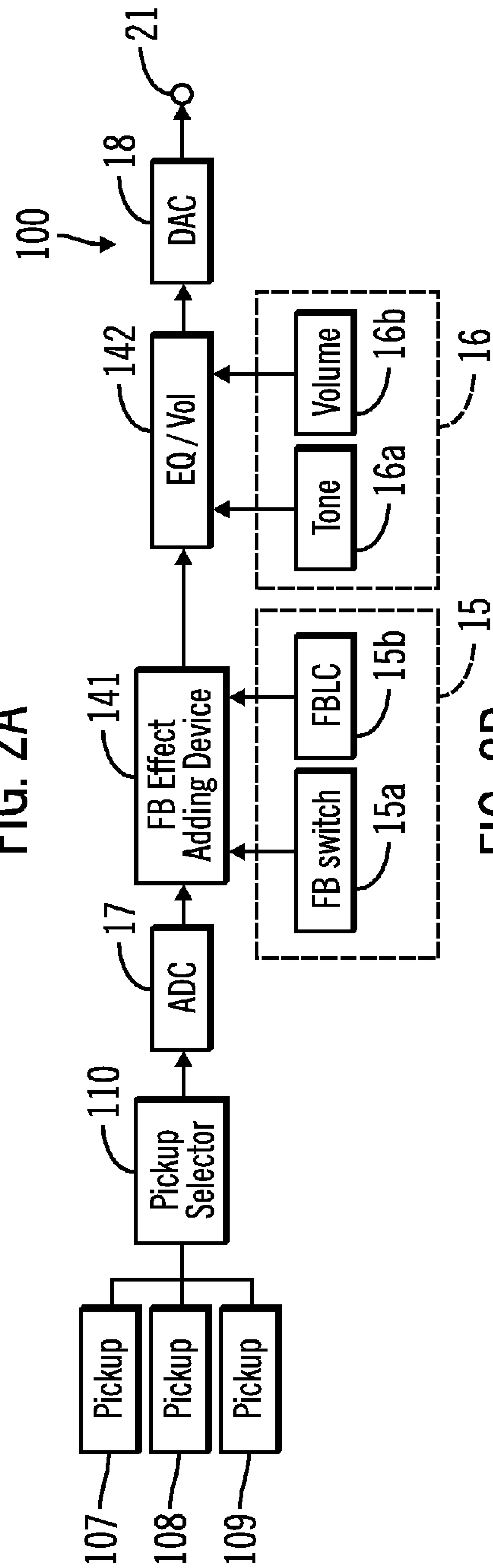
21
18
DAC
100
142
EQ/Vol
Volume
16b
Tone
16a
16
141
FB Effect Adding Device
FBLC
15b
FB switch
15a
15
17
ADC
110
Pickup Selector
Pickup
Pickup
Pickup
107
108
109

FIG. 2B

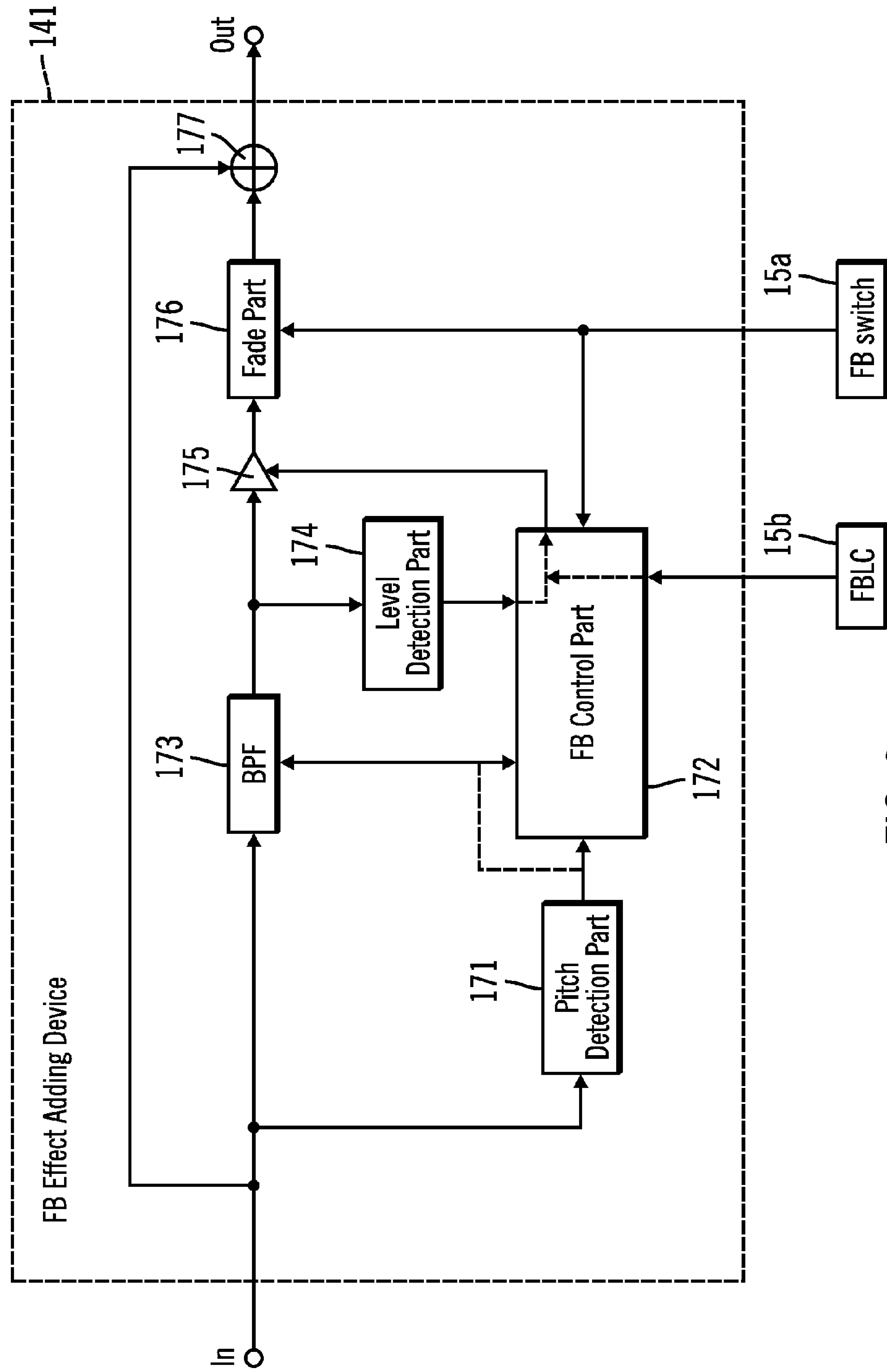
141
FB Effect Adding Device
In
Out
171
Pitch Detection Part
172
FB Control Part
173
BPF
174
Level Detection Part
175
176
Fade Part
177
15a
FB switch
15b
FBLC

FIG. 3

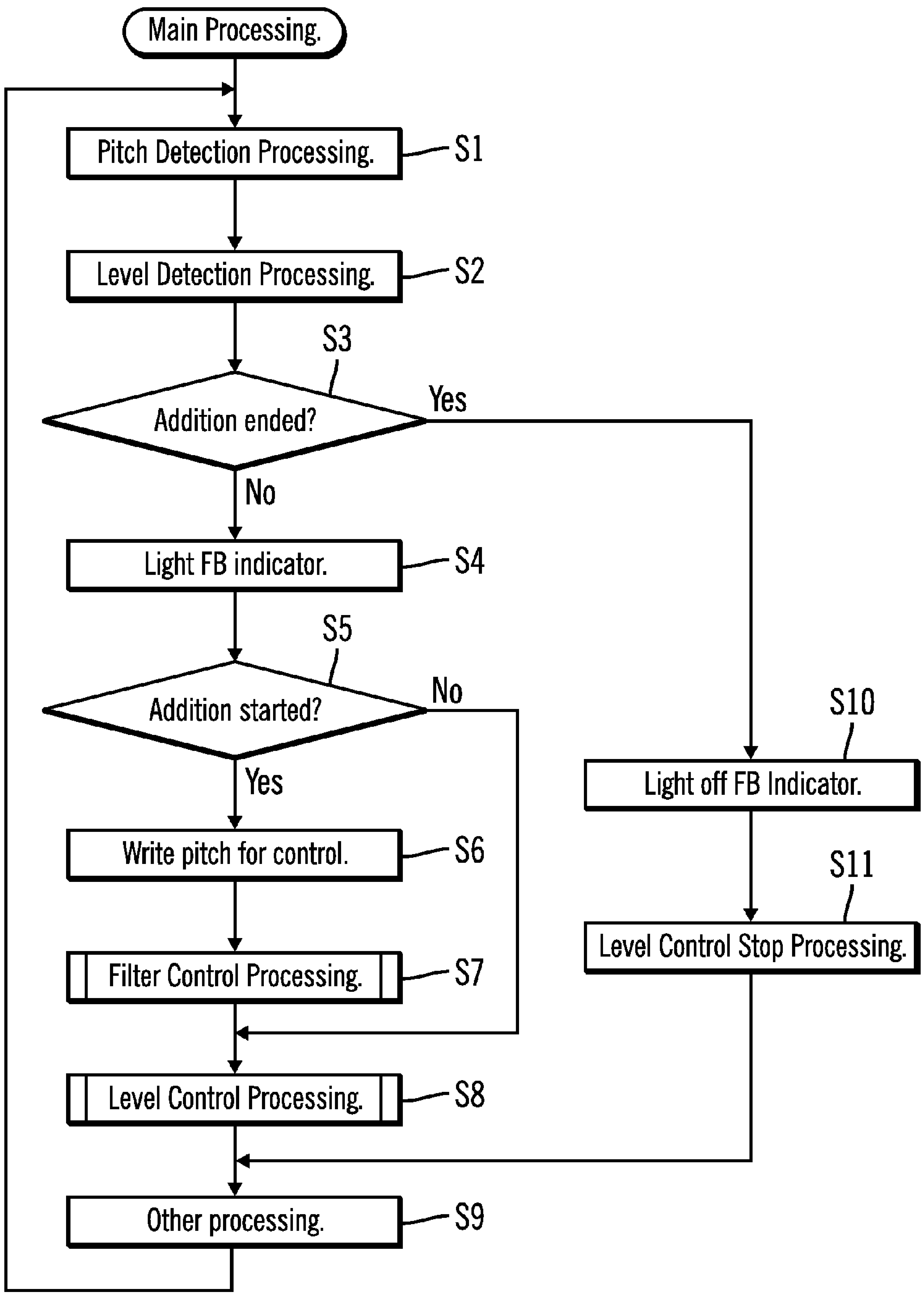
Main Processing.
Pitch Detection Processing.
S1
Level Detection Processing.
S2
S3
Addition ended?
Yes
No
Light FB indicator.
S4
S5
Addition started?
No
Yes
Write pitch for control.
S6
Filter Control Processing.
S7
Level Control Processing.
S8
Other processing.
S9
S10
Light off FB Indicator.
S11
Level Control Stop Processing.

FIG. 4

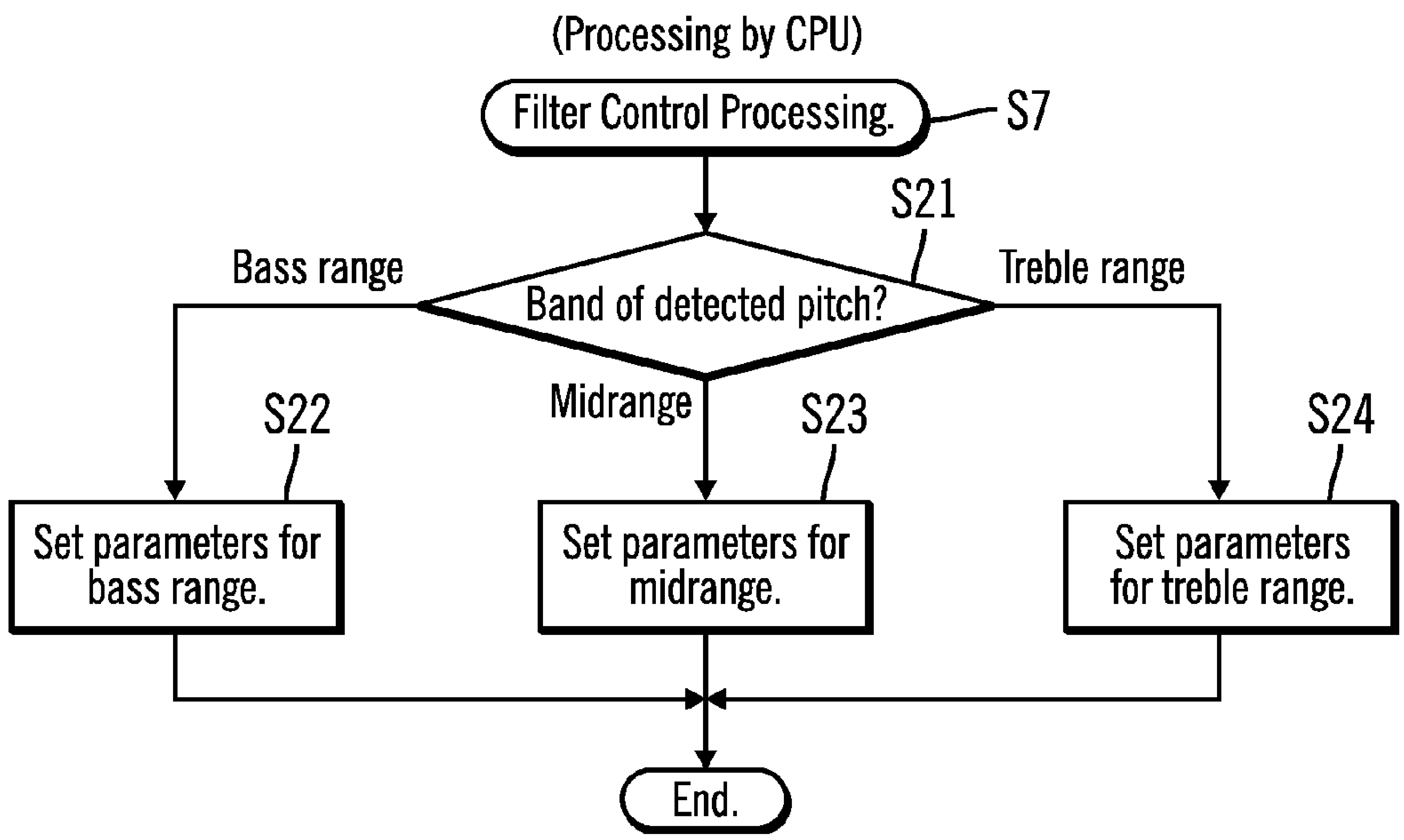
(Processing by CPU)
Filter Control Processing.
S7
S21
Bass range
Band of detected pitch?
Treble range
Midrange
S22
S23
S24
Set parameters for bass range.
Set parameters for midrange.
Set parameters for treble range.
End.

FIG. 5A

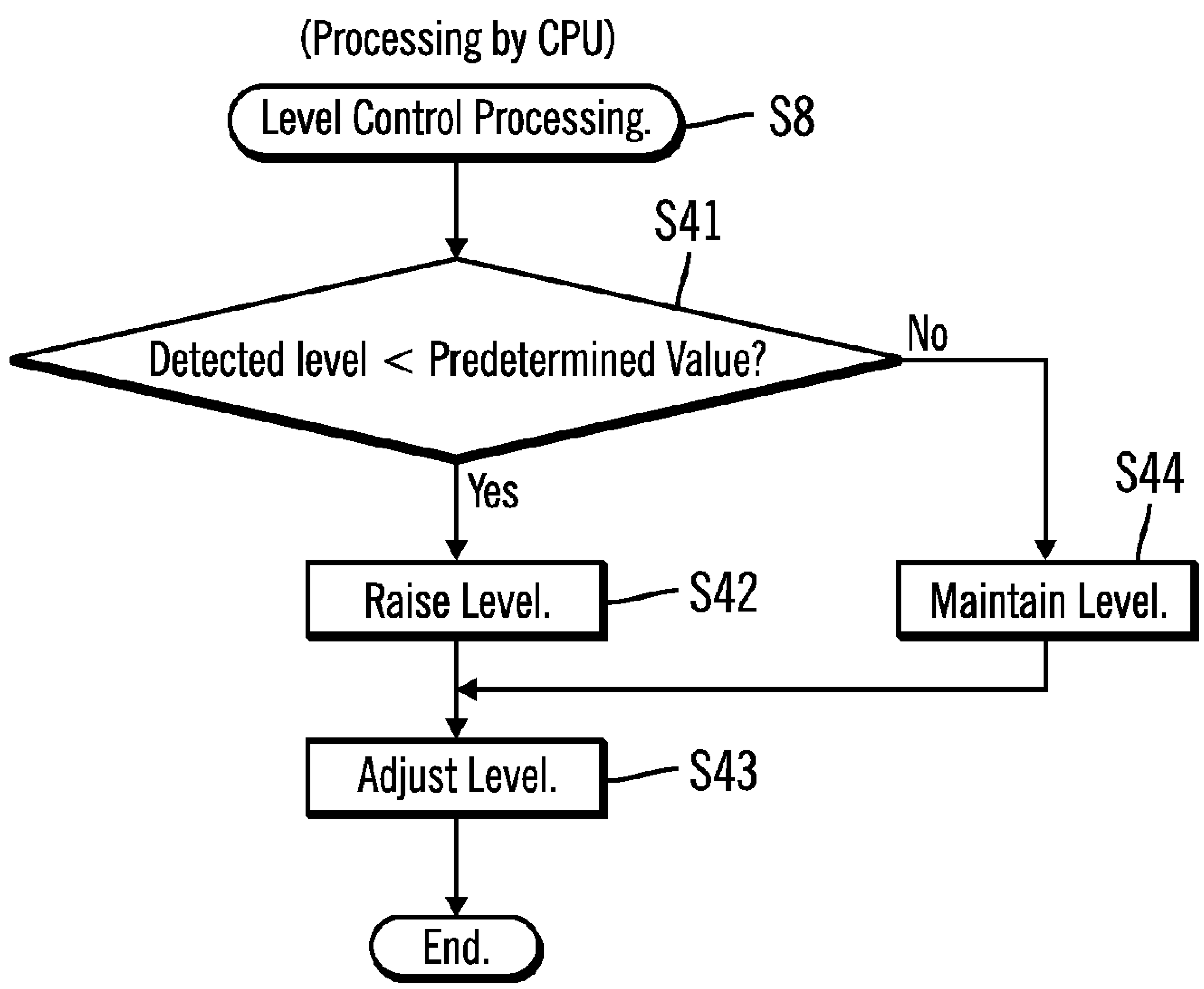
(Processing by CPU)
Level Control Processing.
S8
S41
Detected level < Predetermined Value?
No
Yes
S44
Raise Level.
S42
Maintain Level.
Adjust Level.
S43
End.

FIG. 5B

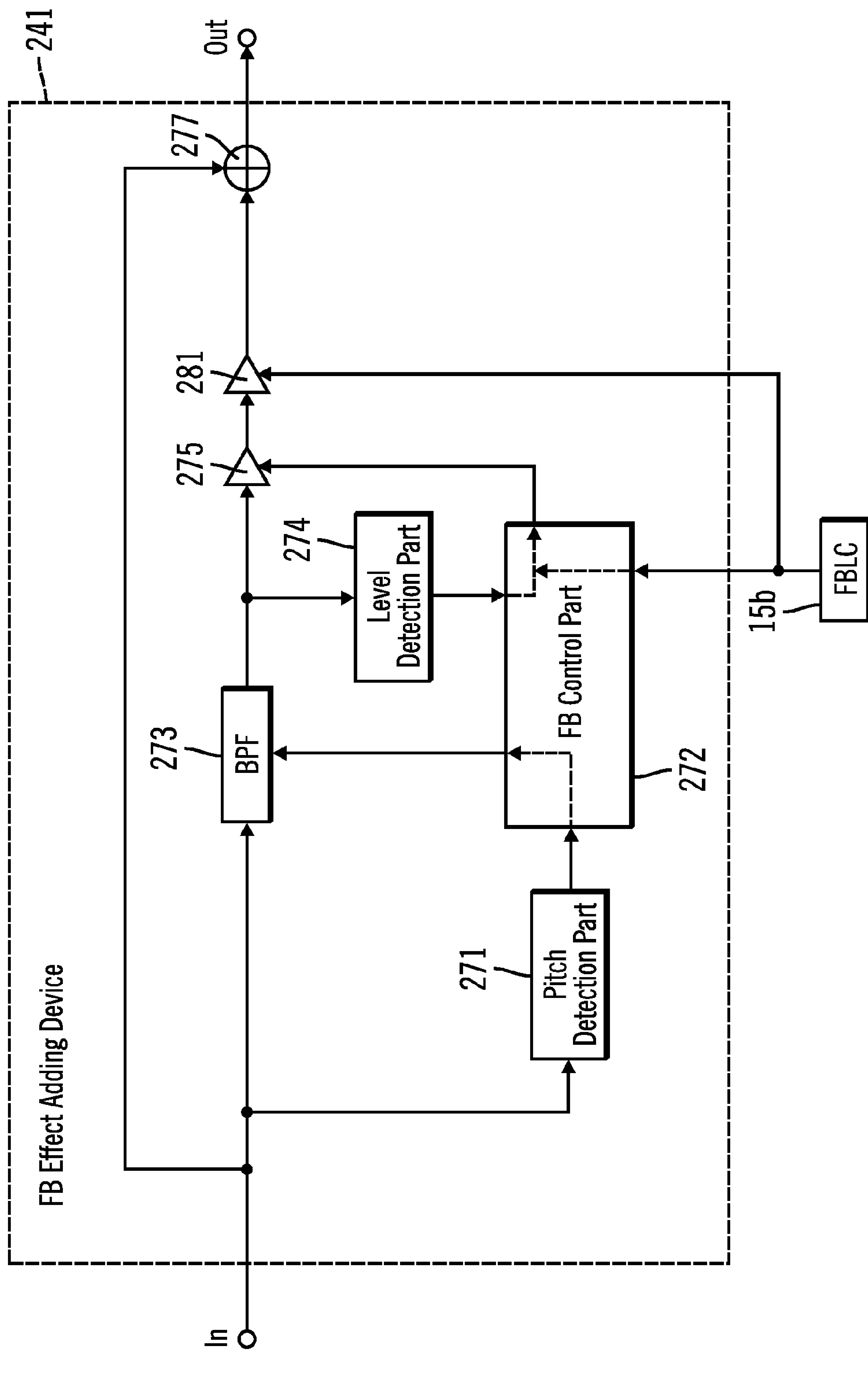
241
FB Effect Adding Device
In
Out
277
281
275
274
Level Detection Part
273
BPF
FB Control Part
272
271
Pitch Detection Part
15b
FBLC

FIG. 6

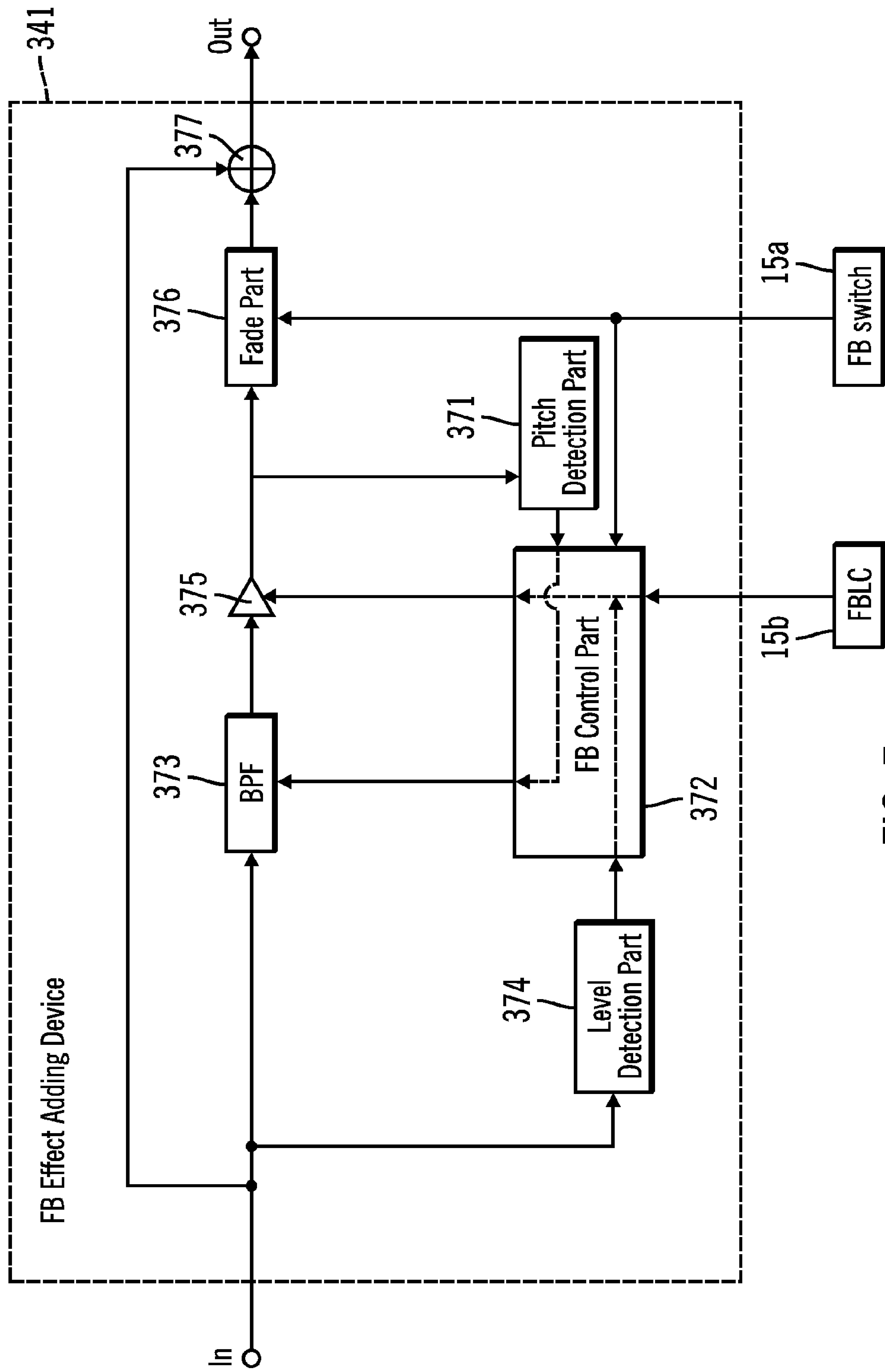
341
FB Effect Adding Device
In
Out
373
BPF
375
371
Pitch Detection Part
376
Fade Part
377
FB Control Part
372
374
Level Detection Part
15a
FB switch
15b
FBLC

FIG. 7

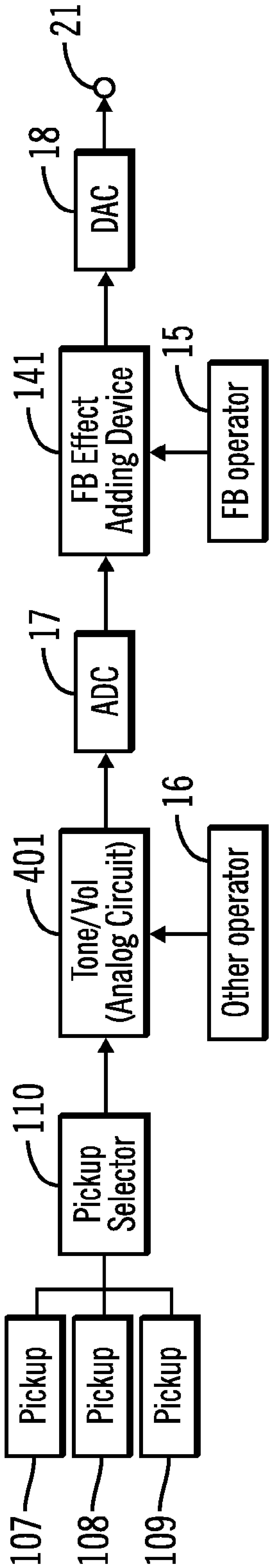
107
108
109
Pickup
Pickup
Pickup
110
Pickup Selector
401
Tone/Vol (Analog Circuit)
16
Other operator
17
ADC
141
FB Effect Adding Device
15
FB operator
18
DAC
21

FIG. 8A

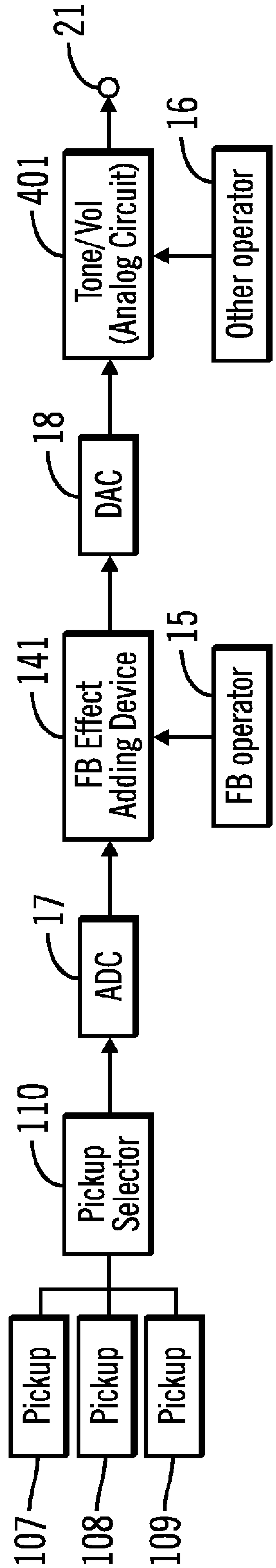
107
108
109
Pickup
Pickup
Pickup
110
Pickup Selector
17
ADC
141
FB Effect Adding Device
15
FB operator
18
DAC
401
Tone/Vol (Analog Circuit)
16
Other operator
21

FIG. 8B

ELECTRONIC STRINGED INSTRUMENT HAVING EFFECT DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application claims the benefit of U.S. Provisional Application No. 61/597,636, filed Feb. 10, 2012, which Provisional Application is incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to electronic stringed instrument having effect devices.

2. Description of the Related Art

An important performance technique for the electric guitar, which is one of the stringed instruments, is feedback performance. In the feedback performance, the performer strikes (plucks) the strings of the electric guitar, and then the performer moves the electric guitar, while the strings are still vibrating, close to a loudspeaker of a guitar amplifier that is amplifying musical tones based on the plucking of the strings and emanating sounds of the amplified tones. By carrying out this operation, a feedback loop is formed from the strings of the electric guitar, the loudspeaker and the acoustic space between them. In this feedback loop, the strings being plucked are further vibrated by resonance caused by the musical tones (musical tones based on plucking of the strings) emanated from the loudspeaker, whereby the feedback performance can be realized.

However, the feedback performance is a performance technique that requires subtle control in, for example, the manner and the strength in which the strings are plucked, the distance between the strings and the loudspeaker, the direction and timing in which the strings are moved closer to the loudspeaker, the sound volume (output level) of musical tones emanated from the loudspeaker and the like, which is a very difficult performance technique for the musicians. Therefore, the performers often fail in the feedback performance.

Japanese Utility Model Patent Application HEI 6-25898 ("JP Application HEI 6-25898") describes an effect device that detects the pitch of a musical tone pronounced by plucking the strings, and sets a band-pass filter to pass only the frequency components in a predetermined passband width in which the frequency corresponding to the detected pitch is assumed to be a center frequency.

According to the effect device described in JP Application HEI 6-25898, the musical tone with a desired pitch pronounced by plucking the strings (that is, in the electric guitar, the musical tone with a pitch that is specified by the performer by pressing the strings against the fret, and may be referred to as the "fundamental (fundamental tone)" or the "keynote") in which the frequency component of the musical tone is emphasized can be output and, as a result, the vibration of the strings can be continued with the frequency of the fundamental.

SUMMARY

Provided is an electronic stringed instrument comprising: a pickup that detects vibration of a string; a feedback operator used to select a level of feedback effect; a feedback control device that controls to add a feedback effect to a tone signal based on the vibration of the string detected by the string vibration detection device and based on the selected level of feedback effect from the feedback operator; and an output device that outputs the tone signal to which the feedback effect is added by the feedback control device.

Further provided is an electronic stringed instrument used by a performer, comprising: a string vibration detection device that detects vibration of a string; an effect adding device that adds a predetermined effect to a string signal detected by the string vibration detection device; and a touch detection part that detects a touch by a performer, wherein the effect adding device is turned on when the touch by the performer is detected and a result of the detecting is ON.

Further provided is an electronic stringed instrument comprising: a string vibration detection device that detects vibration of a string; an effect adding device that adds a predetermined effect to a string signal detected by the string vibration detection device; and a touch detection part that detects a touch by a performer, wherein the effect by the effect adding device is switched on/off, when the touch by the performer is detected and a result of the detecting is ON.

Further provided is an electronic stringed instrument used by a performer, comprising: a string vibration detection device that detects vibration of a string; an effect adding device that adds a predetermined effect to a string signal detected by the string vibration detection device; a touch detection part that detects a touch by the performer; and an indicator that visually displays on/off of the effect, wherein the effect by the effect adding device is switched ON, when the touch by the performer is detected and a result of the detecting is ON, and the display state of the indicator is changed.

Further provided is an effect device comprising: an input device to which a tone signal based on vibration of strings of a stringed instrument is input; a filter device that passes the tone signal from the input device; a pitch detection device that detects a pitch of the tone signal from the filter device and/or a pitch of the tone signal to be input to the filter device; an output device that outputs the tone signal output from the filter device; a feedback switch that is capable of switching the feedback effect on and off; and a setting device that sets a parameter of the filter device corresponding to the pitch detected by the pitch detection device when the feedback switch is turned on, and that resets a parameter of the filter device corresponding to the pitch detected by the pitch detection device if the difference of the pitches between the pitch detected by the pitch detection device and the pitch that was used to determine the current parameter of the filter device is greater than a predetermined value.

Further provided is an effect device comprising: an input device receiving a tone signal based on vibration of strings of a stringed instrument; a filter device that passes the tone signal input from the input device; a pitch detection device that detects a pitch of the tone signal input from the filter device and/or a pitch of the tone signal to be input to the filter device; an output device that outputs the tone signal output from the filter device; a feedback switch that is capable of switching on and off of the feedback effect; a setting device that sets a parameter of the filter device corresponding to the pitch detected by the pitch detection device when the feedback switch is turned on, and that re-sets a parameter of the filter device corresponding to the pitch detected by the pitch detection device if the difference of the pitches between the pitch detected by the pitch detection device and the pitch that was used to determine the current parameter of the filter device is greater than a predetermined value; a level detection device that detects a level of the tone signal output from the filter device and/or a level of the tone signal to be input in the filter device; and a level control device that controls the level of the tone signal output outside from the output device to have a level corresponding to the level detected by the level detection device.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front view showing an electronic guitar in accordance with an embodiment of the invention.

FIG. **2**(*a*) is a block diagram showing the composition of the electronic guitar.

FIG. **2**(*b*) is a functional block diagram showing the functions of the electronic guitar.

FIG. **3** is a functional block diagram showing detailed functions of a feedback effect device.

FIG. **4** is a flow chart showing a main processing executed by CPU.

FIGS. **5**(*a*) and **5**(*b*) are flow charts showing a filter control processing and a level control processing executed in the main processing of FIG. **4**, respectively.

FIG. **6** is a functional block diagram showing detailed functions of a feedback effect device.

FIG. **7** is a functional block diagram showing detailed functions of a feedback effect device.

FIGS. **8**(*a*) and **8**(*b*) are functional block diagrams showing detailed functions of an electronic guitar.

DETAILED DESCRIPTION

Even by using the effect device described in JP Application HEI 6-25898, the level of feedback sound is naturally attenuated such that the vibration of the strings of the stringed instrument cannot be stably maintained, or more intense feedback (howling) that becomes unpleasant noise and is different from what the performer intended may result, and therefore there was room for a further improvement.

To counter this problem, it is conceivable to control the level of a tone signal to be output outside according to the level of the tone signal acquired after it has passed a filter or before it passes the filter. According to the effect device that performs such control, the vibration of the guitar strings can be stably maintained by performing automatic control according to the level of the feedback sound, whereby the feedback performance can be done much easier. Moreover, by a composition in which parameters of a filter that passes the tone signal generated based on plucking are set according to the detected pitch of the tone signal, the tone signal with a frequency characteristic suitable for the feedback performance can be output, such that suitable feedback performance can be carried out with ease.

However, because the conventional effect device is composed as an independent unit, it is necessary to connect the electric guitar, the effect device, and the amplifier together one by one in the correct order, and it took time for the installation (setting), which is cumbersome.

Moreover, it is difficult to change the setting of the effect during performance, when the effect device is a floor installation type effector operated with the pedal. Therefore, for example, it is not possible to respond to the demand for feedback effects with a different setting in a series of tunes. Moreover, because the feedback effect changes depending on the volume and the tone (for instance, tone setting of the guitar, etc.), and the direction of the guitar at the moment, there is a demand for fine-tuning the effect according to the situation. However, such a demand cannot be met in the floor installation type effector. In addition, the performer needs to be at the position where the performer can operate the pedal. Therefore, the standing position of the performer is limited, and the limitation is imposed on the staging and the performance.

How the feedback effect occurs greatly differs depending on the distance between the performer and the amplifier (speaker) and their positional relation. Therefore, even if the restriction that requires the performer to be at the position where the performer can operate the pedal is cancelled, and even if the performer can operate the floor installation type effector while performing at any arbitrary positions, the performer needs to change the setting properly according to the performance position in order to achieve the best feedback effect.

The described embodiments provide an electronic stringed instrument by which feedback performance can be easily performed, compared to the case where an effect device for adding feedback effect is provided as an independent unit.

An electronic stringed instrument in accordance with an embodiment of the invention includes: a pickup that detects vibration of strings; a feedback operator that can be arbitrarily operated; a feedback control device that controls to give feedback effect, based on the operation of the feedback operator, to tone signal based on the vibration of the strings detected by the pickup; and an output device that outputs the tone signal with the feedback effect added by the feedback control device. Because the electronic stringed instrument described above is provided with the feedback operator installed thereon, the performer can add feedback effect to the tone signal generated based on the vibration of the strings by operating the feedback operator. Therefore, according to certain described embodiments, the performer can easily perform the feedback performance in an arbitrary part of a music tune being performed, compared with the case in which the effect device for adding feedback effect is installed as an independent unit.

In the electronic stringed instrument, the feedback operator may comprise a setting operator that sets the level of the feedback effect. This operator is installed at a position in the main body of the stringed instrument where the performer can easily operate while performing. Therefore, the performer can arbitrarily perform the feedback performance with an appropriate level in an arbitrary part of the music being performed regardless of the performer's own standing position (the position with respect to the amplifier, etc.).

Moreover, in the electronic stringed instrument described above, the feedback operator may comprise an operator capable of switching on and off of the feedback effect. For instance, the operator capable of switching on and off of the feedback effect may use various sensors and switches, such as, a pressure sensor, a push switch, an electrostatic touch switch, and the like. This operator may be installed at a position in the main body of the stringed instrument that can be easily operated while the player is performing. Therefore, the performer can switch on and off the feedback performance at any time while performing, regardless of own standing position.

Moreover, in the electronic stringed instrument of certain embodiments, the parameter of the filter device to pass the tone signal input from the input device is set according to the pitch detected by the pitch detection device. Also, the level of the tone signal output from the filter device and/or the level of the tone signal input to the filter device are detected by the level detection device. And, the level of the tone signal output from the output device to the outside is controlled according to the level detected by the level detection device. Therefore, the feedback performance can be stably carried out.

Embodiments are described with reference to the accompanying drawings. FIGS. **1-5** show a first embodiment of the embodiments.

FIG. **1** is a front view showing an electronic guitar **100** that is one embodiment of an electronic stringed instrument of the invention. The electronic guitar **100** of the embodiment is composed in a manner that the feedback performance can be done arbitrarily and stably regardless of the standing position of the performer.

As shown in FIG. **1**, the electronic guitar **100** has a body **102**, a neck part **103** attached to the body **102**, and a head part **104** connected to the neck part **103**.

A bridge **106** is provided in the body **102**. One ends of six strings **105** are attached to the bridge **106**. The other ends of these strings **105** are attached to pegs installed in the head part **104**. The strings **105** are stretched over the front surface side of the body **102**. The bridge **106** is installed in a manner moveable about a center axis (not shown), and biased in a direction in which the strings **105** are stretched by a spring (not shown) in the normal state.

The body **102** is provided with pickups **107**, **108** and **109** that detect vibration of the six strings **105**, and output string signals as tone signals.

Among the three kinds of the pickups **107**, **108** and **109**, the pickup **107** that is the nearest to the bridge **106** comprises a rear pickup, and the pickup **109** that is remotest from the bridge **106** comprises a front pickup. The pickup **108** located between the pickup **107** and the pickup **109** comprises a center pickup. The pickups **107**, **108** and **109**, may comprise electromagnetic type pickups that electromagnetically detect the vibration of the strings **105**. However, other types of pickups may be used, without any particular limitation to the above.

A jack **21** (see FIG. **2**(*a*)), that takes out the output signal based on the string signal output from each of the pickups **107**, **108** and **109** outside, is installed on the body **102**. The output signal based on the string signal (the string signal as is, or the string signal with the effect added) is emanated from the guitar amplifier (the speaker) (not shown) via a cable **120** connected to the jack **21**.

A pickup selector **110** in a lever switch, rotary operation knobs **111-114**, a touch switch **115**, and a tremolo arm **116** are set up in the body **102**, as shown in FIGS. **1**, **2**(*a*), and **2**(*b*).

The pickup selector **110** selects one of the pickups to be used when performing among the three kinds of the pickups **107**, **108** and **109**. The pickup selector **110** is used to select a pickup among the three pickups **107**, **108** and **109**, to be used during performance. The performer operates the pickup selector **110** to select a desired pickup from among the pickups **107**, **108** and **109**.

The operation knobs **111** and **112** each constitute a tone **16***a* (see FIG. **2**(*b*)) that sets a timbre (tone). The performer rotationally operates the operation knob **111**, whereby the timbre of the front pickup **109** can be adjusted. On the other hand, by rotationally operating the operation knob **112**, the performer can change the timbre of the center pickup **108**. The operation knob **113** may comprise a volume **16***b* (see FIG. **2**(*b*)) that sets a volume (master volume). By rotationally operating the operation knob **113**, the performer can adjust the volume.

The touch switch **115** is a touch switch of static electricity type (electrostatic capacity type), and comprises a feedback switch **15***a* (FB switch) (see FIG. **2**(*a*)) that switches on and off the feedback effect. When the performer touches the touch switch **115**, the electrostatic capacity sensor, that comprises a switch part of the FB switch **15***a*, detects a change in the electrostatic capacity, and the detection result is output to CPU **11** (see FIG. **2**(*a*)). CPU **11** receives the detection result, and outputs an instruction to turn on the feedback effect to the feedback effect device (FB effect adding device) **141** (see FIG. **2** (*b*)). As a result, while the performer touches the touch switch **115**, the feedback performance in which the feedback effect is added to the output sound can be performed. The feedback effect may be switched on and off each time the touch switch **115** is touched.

A feedback indicator **117** is an LED indicator that lights when the feedback effect is turned on, and goes off when the effect is turned off.

The tremolo arm **116** has an arm **116***a* and may be connected with the bridge **10** by a screw. By operating the tremolo arm **116** in a manner to bring closer to the body **102**, the bridge **106** swings around the axis (not shown) as a center, whereby the tension added to the strings **105** can be weakened. Therefore, the pitch can be changed up and down by bringing the tremolo arm **116** closer to or away from the body **102**.

The tremolo arm **116** also comprises the FB switch **15***a*. Specifically, the arm **116***a* is formed from an electroconductive material (for instance, metal, electroconductive polymer, etc.), and comprises a detection part of the FB switch **15***a*. The electrostatic capacity sensor, that comprises the switch section of the FB switch **15***a*, detects a change in the electrostatic capacity when the performer touches the arm **116***a*, and the detection result is output to CPU **11**.

CPU **11** receives the detection result, and outputs an instruction to turn on the feedback effect to the feedback effect device (FB effect adding device) **141** (see FIG. **2**(*b*)). As a result, the feedback performance can be executed while the performer is touching the arm **116***a*.

Therefore, according to certain electronic guitar **100** embodiments, while touching the arm **116***a*, the performer can perform the feedback performance while giving vibrato by bringing the tremolo arm **116** closer to and away from the body **102**. Moreover, only the feedback effect can be turned on without adding vibrato, by maintaining the state in which the tremolo arm **116** is lightly touched without applying force.

The arm **116***a* is electrically insulated from the bridge **106** in the connected part with the bridge **106**. As a result, the FB switch **15***a* and the strings **105** are electrically insulated from each other, and the feedback effect is prevented from turning on upon the player's touching the strings **105**. In embodiments where the bridge **106** is formed from an insulator, the FB switch **15***a* and the strings **105** can be insulated electrically.

The operation knob **114** comprises a feedback level control operator (FBLC=Feed Back Level Controller) **15***b* (See FIG. **2**(*a*)) that adjusts (sets) the level of the feedback effect. More specifically, the operation knob **114** comprises an operation part of the FBLC (**15***b*). When the performer rotationally operates the operation knob **114**, a variable resistor, that is the detection part of the FBLC (**15***b*), detects the amount of the operation (amount of the rotation) by the operation knob **114**, and outputs an electric signal corresponding to the detected amount of the operation to CPU **11**. CPU **11** controls the level of the feedback effect based on the electric signal output from the FBLC (**15***b*).

The operation knob **114** also comprises the FB switch **15***a*. Specifically, the operation knob **114** may be comprised of electroconductive material (for instance, metal, electroconductive polymer, etc.), and comprises a detection part of the FB switch **15***a*. The operation knob **114** is electrically connected with a case (not shown in the figure) that accommodates a rotation shaft (not shown in the figure) that can be turned by rotating the operation knob **114** and the detection part of the FBLC (**15***b*). The case is connected with an electrostatic capacity sensor that comprises the switch of the FB switch **15***a*. The electrostatic capacity sensor detects a change in the electrostatic capacity when the performer touches the operation knob **114**, and the detection result is output to CPU **11**. CPU **11** receives the detection result, and outputs an instruction to turn on the feedback effect to the FB effect adding device **141**. As a result, while touching the operation knob **114**, the performer can perform the feedback performance. Therefore, according to the electronic guitar **100** of the embodiment, the performer can adjust the level of the feedback effect by pinching and operating (rotating) the operation knob **114** while performing the feedback performance.

The variable resistor (including the terminals), that is the detection part of the FBLC (**15***b*), is electrically insulated from the case that accommodates the detection part. Therefore, even when the case that accommodates the detection part (variable resistor) of the FBLC (**15***b*) and the switch part (electrostatic capacity sensor) of the FB switch **15***a* are electrically connected, sensing of the amount of operation by the FBLC (**15***b*) is not influenced. In one embodiment, the operation knob **114** or the rotation shaft has electro-conductivity and the switch part of the FB switch **15***a* may be electrically connected to the operation knob **114**.

According to the electronic guitar **100** of the embodiment, by touching the touch switch **115**, the arm **116***a* of the tremolo arm **116** or the operation knob **114**, the performer can add the feedback effect while they are being touched.

In other words, by touching these parts **115**, **116***a* and **114**, the performer can perform the feedback performance. On the other hand, unless these parts **115**, **116***a* and **114** are touched, the feedback effect is not added and the feedback performance is not performed. Therefore, the performer can arbitrarily switch on and off the feedback performance at any time while performing, regardless of the standing position of the performer. Moreover, the state of on/off of the feedback effect can be easily checked visually by the display on the feedback indicator **117**. Moreover, according to the electronic guitar **100** of the embodiment, the level of the feedback effect can be adjusted by operating the operation knob **114**. Therefore, the performer can appropriately adjust (for example, fine-tune) the level of the feedback effect at any time during performance regardless of own standing position.

FIG. **2**(*a*) is a block diagram showing the electric composition of the electronic guitar **100**. The electronic guitar **100** has central processing unit (CPU) **11**, Read Only Memory (ROM) **12**, Random Access Memory (RAM) **13**, a digital signal processor (DSP) **14**, a feedback operator (FB operator) **15**, other operators **16**, and an indicator **20**, and these parts **11-16** and **20** are connected mutually through a bus line **19**.

The electronic guitar **100** also includes an analog to digital converter (ADC) **17** and a digital to analog converter (DAC) **18**. ADC **17** is connected with the pickup selector **110** and DSP **14**. DAC **18** is connected to DSP **14** and the jack **21**. CPU **11**, ROM **12**, RAM **13**, DSP **14**, ADC **17**, DAC **18**, and the bus line **19** are built into the body **102** as a controller device.

From analog string signals supplied from each of the pickups **107**, **108** and **109**, string vibration of desired one or a plurality of the pickups is selected by the pickup selector **110**, converted into digital signals by ADC **17**, and input to DSP **14** and processed. On the other hand, the signal processed in DSP **14** is converted into an analog signal by DAC **18** and output through the jack **21**. The signal output through the jack **21** is emanated from the guitar amplifier (speaker) (not shown in the figure). A feedback loop can be formed with the strings **105** of the electronic guitar **100**, the guitar amplifier (speaker) connected to the jack **21** and the acoustic space formed between them.

CPU **11** is a central control unit that controls each part of the electronic guitar **100** according to fixed value data and a control program stored in ROM **12** and RAM **13**. ROM **12** is a non-rewritable memory, and stores a control program **12***a* that renders CPU **11** and DSP **14** to execute each processing, and fixed value data (not shown in the figure) referred to by CPU **11** when the control program **12***a* is executed. Each processing shown in the flow charts of FIG. **4**, FIG. **5**(*a*), and FIG. **5**(*b*), to be described, below is executed by CPU **10** according to the control program **12***a*. RAM **13** is a rewritable memory, and has a work area (not shown in the figure) to store various data temporarily when CPU **11** executes the control program **12***a*. DSP **14** is an arithmetic unit to process digital signals.

The FB operator **15** is an operator for controlling the feedback effect. In the present embodiment, the FB operator **15** is configured with an FB switch **15***a* to switch on and off the feedback effect, and a FBLC (**15***b*) for adjusting the level of the feedback effect. The other operator **16** is an operator other than the FB operator **15**.

FIG. **2**(*b*) is a functional block diagram showing the functions of the electronic guitar **100**. The analog string signal selected by the pickup selector, as shown in FIG. **2** (*b*), is input to ADC **17**. The input analog signal is converted into a digital signal by ADC **17**, and supplied to the FB effect adding device **141**.

The FB effect adding device **141** is a function to add the feedback effect to an original sound based on vibration of the strings **105**, and it is at least achieved by the processing of DSP **14**. The FB effect adding device **141** is connected with the FB operator **15** (FB switch **15***a* and FBLC **15***b*) via an analog to digital converter (not shown). When the feedback effect is turned off, the FB effect adding device **141** supplies the digital signal supplied from ADC **17** to EQ/Vol **142** in a succeeding stage as it is.

On the other hand, when the feedback effect is turned on by the FB switch **15***a*, the FB effect adding device **141** adds the feedback effect at the level corresponding to the amount of the operation of the FBLC (**15***b*) to the digital signal supplied by ADC **17**, and supplies the same to EQ/Vol **142** in the succeeding stage.

EQ/Vol **142** is a function to control the tone and the volume of the signal (tone signal) output from the FB effect adding device **141**, and it is realized by cooperative processing with CPU **11** and DSP **14**. The other operator **16** is connected with EQ/Vol **142** through the analog to digital converter (not shown). In one embodiment, the other operator **16** is configured with a tone **16***a* and a volume **16***b*. The tone **16***a* outputs an electric signal corresponding to the amount of operation of the operation knobs **111** and **112**. The volume **16***b* outputs an electric signal corresponding to the amount of operation of the operation knob **113**.

EQ/Vol **142** controls the digital signal supplied by the FB effect adding device **141** to have a timbre and a volume corresponding to the electric signal input from the tone **16***a* and the volume **16***b* (that is, corresponding to the operation of the operation knobs **111-113**), and supplies the same to DAC **18**. DAC **18** converts the digital signal input from EQ/Vol **142** into an analog signal, and output the signal through the jack **21**.

FIG. **3** is a functional block diagram showing detailed functions of the FB effect adding device **141** described above. Among the functions shown in FIG. **3**, each of the parts **171**, **172**, **174** and **176** is a function achieved by cooperative processing done by CPU **11** and DSP **14**. Each of the parts **173** and **175** is a function achieved by processing of DSP **14**.

The digital signal input to the FB effect adding device **141** is supplied to the pitch detection part **171**, the band-pass filter (BPF) **173** and the adder **177**. The pitch detection part **171** detects the pitch of the input digital signal (that is, the pitch of the string vibration), and supplies pitch information indicative of the detected pitch to the FB control part **172**.

When the feedback effect is turned on by the FB switch **15***a*, the FB control part **172** sets parameters that specify the filter characteristic to the BPF **173**, based on the pitch information supplied from the pitch detection part **171**. For instance, when the pitch information supplied from the pitch detection part **171** indicates the bass range, the FB control part **172** sets parameters including the center frequency, the Q value and the gain such that the feedback sound may shift to a harmonic of higher-order (for instance, the third harmonic, the fifth harmonic, etc.). Or, for example, when the pitch information supplied from the pitch detection part **171** indicates the midrange, the FB control part **172** sets parameters including the center frequency, the Q value, and the gain such that the feedback sound may shift to the second harmonic. Further, when the pitch information supplied from the pitch detection part **171** indicates the treble range, the FB control part **172** may sets parameters including the center frequency, the Q value, and the gain such that the feedback sound may be maintained at the fundamental (keynote). The parameters for each of the tone ranges may be stored, for example, in ROM **12** in advance.

BPF **173** filters and adjusts the gain of the digital signal input to the FB effect adding device **141** (that is, the digital signal of the string signal output from each pickup **107**, **108**, **109**) and supplies the processed signal to the level detection part **174** and the multiplier **175**.

The level detection part **174** detects the level of the signal output from BPF **173**, and supplies level information indicative of the detected level to the FB control part **172**. The FB control part **172**, when the feedback effect is turned on by the FB switch **15***a*, sets a coefficient to be supplied to the multiplier **175** based on the level information supplied from the level detection part **174**.

Specifically, when the level information supplied from the level detection part **174** shows that the level of the signal output from BPF **173** is below a predetermined level, the FB control part **172** sets a coefficient to raise the level. On the other hand, when the level information supplied from the level detection part **174** shows that the level of the signal output from BPF **173** exceeds the predetermined level, the FB control part **172** sets a coefficient to raise the level. When the level of the signal output from BPF **173** is too large, a coefficient to lower the level may be set.

The FB control part **172**, based on the coefficient set based on the level information supplied from the level detection part **174** and the amount of the operation of FBLC (**15***b*), sets the output value, and supplies the set output value to the multiplier **175**. For instance, the output value may be set by multiplying the coefficient set based on the level information and the value corresponding to the amount of the operation of FBLC (**15***b*). According to the embodiment, it is assumed that the value corresponding to the amount of the operation of FBLC (**15***b*) is a value within the range from **0** to a prescribed value greater than 1. Therefore, when the value corresponding to the amount of the operation of FBLC (**15***b*) is one, the coefficient set based on the level information supplied from the level detection part **174** is supplied to the multiplier **175** as an output value. On the other hand, when the value corresponding to the amount of the operation of FBLC (**15***b*) is zero, zero is supplied to the multiplier **175** as an output value. The setting of the output value may be configured, without being limited to the above-described multiplication, such that a predetermined value decided according to the amount of the operation of FBLC (**15***b*) may be added to or subtracted from the coefficient set based on the level information.

The multiplier **175** multiplies the signal output from BPF **173** by the output value supplied by the FB control part **172** to adjust the level of the output signal from BPF **173**, and supplies the processed signal to a fade part **176**. The fade part **176** fades in or fades out the output signal from the multiplier **175** according to the state of the operation of the FB switch **15***a*, and supplies the signal to the adder **177**. Concretely, when the feedback effect is switched from off to on by the FB switch **15***a*, the fade part **176** increases the level of the signal output from the multiplier **175** with the passage of time, and supplies the signal to the adder **177**. On the other hand, when the feedback effect is switched from on to off by the FB switch **15***a*, the fade part **176** decreases the level of the signal output from the multiplier **175** with the passage of time, and supplies the signal to the adder **177**.

The adder **177** adds the digital signal input to the FB effect adding device **141** (that is, the digital signal of the string signal output from each of the pickups **107**, **108**, **109**) and the signal supplied from the multiplier **175** through the fade part **176**. Therefore, when the feedback effect is turned on by the FB switch **15***a*, the signal in which the feedback effect is added to the string signal detected by each of the pickups **107**, **108** and **109**, is output through the adder **177**. As a result, the tone in which the feedback effect is added to the original sound based on the vibration of the strings **105** is emanated from the guitar amplifier (speaker) (not shown in the figure). According to the FB effect adding device **141**, because the FB control part **172** controls the level of the feedback sound output outside according to the level of the signal output from BPF **173**, attenuation of the level of the signal output from the guitar amplifier to an outside acoustic space can be suppressed, and therefore sustain can be obtained, so that the vibration of the strings **105** of the electronic guitar **100** can be stably maintained.

Next, referring to FIG. **4** and FIG. **5**, the processing executed by CPU **11** of the electronic guitar **100** having the above-described composition will be described. FIG. **4** is a flow chart showing a main processing executed by CPU **11**. The main processing is started when the power supply is turned on to the electronic guitar **100**, and repeatedly executed by CPU **11** while the power supply is turned on.

First, CPU **11** executes a pitch detection processing (S**1**).

Specifically, in the pitch detection processing (S**1**), CPU **11** detects the pitch of the string signal (tone signal) supplied from the pickup selector **110** with the pitch detection part **171**, and stores the detected pitch P**1** in a buffer for storing detected pitch installed in RAM **13**.

Next, CPU **11** executes a level detection processing (S**2**). Specifically, CPU **11** detects the level of the output signal from BPF **173** with the level detection part **174**, and stores the detected level in a buffer L**1** for storing detected level installed in RAM **13**.

Next, CPU **11** judges as to whether the feedback effect (FB effect) is added (S**3**). When the feedback effect is turned on by the FB switch **15***a*, CPU **11** determines that the feedback effect is added (S**3**: No), lights the FB indicator **117** (S**4**), and shifts the processing to S**5**.

In S**5**, when the feedback effect is newly switched on, CPU **11** determines that the feedback effect addition began (S**5**: Yes), and shifts the processing to S**6**. Or, when the difference between the pitch (P**1**) detected in S**1** and stored in the detection pitch storage buffer and the pitch (P**2**) stored in the control buffer used for feedback effect control is greater than a predetermined value (for instance, three semitones), CPU **11** determines that a plucking performance has been newly carried out, and judges that the feedback effect addition has begun (S**5**: Yes), similar to the case where the feedback effect is newly switched on, and shifts the processing to S**6**.

In S**6**, CPU **11** writes the latest pitch P**1** detected in S**1** and stored in the detection pitch storage buffer to the buffer (which is also provided in RAM **13**) that stores the pitch P**2** for control that is used for the feedback effect control.

After the processing in S**6**, CPU **11** executes a filter control processing that sets parameters to BPF **173** (DSP**14**) (S**7**). The filter control processing (S**7**) may comprise a processing that sets, to BPF **173**, parameters corresponding to the frequency band to which the detected pitch belongs. Details of the processing will be described later referring to FIG. **5**.

CPU **11** executes a level control processing (S**8**) for controlling the level of the feedback sound output outside according to the level information stored in the detection level memory buffer in S**2**, and the amount of operation of the FBLC (**15***b*). Processing of the level control processing (S**8**) is described later with reference to FIG. **5**(*b*).

CPU **11** executes other processing and returns the processing to S**1** (S**9**). The other processing (S**9**) includes, for instance, a processing that renders the fade part **176** to execute fade-in or fade-out of the signal output from the multiplier **175** according to the state of operation of the FB switch **15***a*, and the like.

In S**5**, if CPU **11** determines that it is not at the beginning of adding the feedback effect (S**5**: No), this indicates that the feedback performance is continuously being executed. In this case, the CPU **11** shifts the processing to S**8**, and executes the level control processing.

Moreover, in S**3**, if CPU **11** judges that the feedback effect (FB effect) is not added (S**3**: Yes), CPU **11** turns off the FB indicator **117** (S **10**) and executes a level control termination processing that stops the level control by the level control processing in S**7** (S**11**). After the processing S**11**, CPU **11** shifts the processing to S**9**.

FIG. **5**(*a*) is a flow chart showing the filter control processing (S**7**) described above. First, CPU **11** determines the frequency band of the pitch P**2** used for the feedback effect control stored in the buffer in RAM **13** (S**21**).

When the pitch P**2** belongs to a bass range (S**21**: bass range), CPU **11** sets parameters for the bass range to BPF **73** (S**22**), and ends this processing. On the other hand, when the pitch P**2** belongs to a midrange (S**21**: midrange), CPU **11** sets parameters for the midrange to BPF **173** (S**23**), and ends this processing. Also, when the pitch P**2** belongs to a treble range (S**21**: treble range), CPU **11** sets parameters for the treble range to BPF **173** (S**24**), and ends this processing.

FIG. **5**(*b*) is a flow chart showing the level control processing (S**8**) described above. CPU **11** judges as to whether the detected level L**1** is less than a predetermined level (S**41**). In S**41**, if the detected level L**1** is less than the predetermined level (S**41**: Yes), CPU **11** sets a coefficient that raises the level of the signal at the multiplier **178**, and shifts the processing to S**43**.

On the other hand, in S**41**, if the detected level L**1** exceeds the predetermined level (S**41**: No), CPU **11** sets a coefficient that maintains the level of the signal at the multiplier **178** (S**44**), and shifts the processing to S**43**.

In S**43**, CPU **11** sets an output value based on the coefficient set according to S**43** or S**45** and the amount of operation of FBLC (**15***b*) to adjust the level of the signal to be output from the multiplier **175** (S**43**). After the processing in S**43**, CPU **11** ends the present processing.

In a first embodiment when the electronic guitar **100** includes a built-in FB effect adding **141**, as described above, on and off of the feedback effect can be freely switched if necessary by operating the FB switch **15***a*. Therefore, the performer can arbitrarily switch on and off the feedback performance at any time during performance regardless of own standing position.

Moreover, with the electronic guitar **100** of certain embodiments, the level of the feedback effect can be freely changed if necessary by operating FBLC (**15***b*). Therefore, the performer can appropriately adjust the level of the feedback effect at any time during performance regardless of own standing position.

Moreover, with the electronic guitar **100** of certain embodiments, because the FB operator **15** (FB switch **15***a* and FBLC **15***b*) is installed in the main body of the electronic guitar **100**, the setting relating to the feedback effect can be more easily done, compared with the case where the effect device to add feedback effect is provided as an independent unit.

In addition, upon detecting the level of the output signal from BPF **173**, when the level is smaller than the predetermined level, the FB effect adding device **141** is configured to perform the control to raise the signal level. As a result, attenuation of the level of the signal to be output from the guitar amplifier to an outside acoustic space is suppressed, and therefore sustain can be obtained, the vibration of the strings **105** of the electronic guitar **100** by the feedback sound can be stably maintained. In this way, the feedback performance can be stably performed according to the electronic guitar **100** with the built-in FB effect adding device **141**. Furthermore, because the level of the signal with a specific frequency characteristic that passed BPF **173** is controlled, the level of the signal with frequency characteristic that becomes the source of unpleasant sound (so-called howling) can be prevented from rising. Therefore, the feedback performance can be done while preventing generation of unpleasant sound.

Moreover, according to the FB effect adding device **141**, because the level of the signal with a specific frequency characteristic that passed the BPF **173** can be maintained at some level, the feedback performance is enabled, even if it is a small volume or a low amount of gain, at which the feedback performance cannot normally be realized. Therefore, according to the electronic guitar **100** with the built-in FB effect adding device **141**, the limitation imposed on the environment in which the feedback performance is carried out, for example, the use of a large-scale guitar amplifier, and the like can be eliminated. As a result, the feedback performance can be achieved with a small guitar amplifier.

Also, the FB effect adding device **141** detects the pitch of the string vibration of the strings **105** of the electronic guitar **100**, and sets the filter characteristic of BPF **173** corresponding to the detected pitch. Therefore, BPF **173** outputs the signal with the frequency characteristic corresponding to the pitch of the string vibration input. If the filter characteristic of BPF **173** is set so that the signal output from BPF **173** has a frequency characteristic suitable for the feedback performance, the signal of the suitable frequency characteristic for the feedback performance can be output to an outside acoustic space through the guitar amplifier (speaker). As a result, the vibration of the strings **105** of the electronic guitar **100** due to the feedback sound can be stably maintained by the tone emanated from the guitar amplifier. According to the electronic guitar **100** with the built-in FB effect adding device **141**, the feedback performance can be stably carried out in the points described above.

A second embodiment of the embodiments is described with reference to FIG. **6**.

In the first embodiment described above, the switching on and off the feedback effect is done by the FB switch **15***a*, and the level of the feedback effect is adjusted (set) by FBLC (**15***b*). In a further embodiment, application of the feedback effect is controlled by FBLC (**15***b*) without using the FB switch **15***a*. In other words, in the embodiment of FIG. **6**, the FB operator **15** does not include the FB switch **15***a*, but has the FBLC (**15***b*). With respect to the description of the second embodiment of FIG. **6**, different reference numerals are assigned to the same parts shown in FIG. **3** for the different configuration of FIG. **6**.

In the first embodiment of FIG. **3**, the determination in S**3** is executed depending on the state of the FB switch **15***a*.

However, in the second embodiment of FIG. **6**, when the value of FBLC (**15***b*) is zero, CPU determines that application of the feedback effect ended (S**3**: Yes). Moreover, when the signal level L**1** detected in S**2** in the main processing is smaller than the predetermined value, CPU assumes that there is an attempt to mute or silence the performance sound, and determines that the application of the feedback effect ended (S**3**: Yes). When a determination is made that the feedback effect adding ended (S**3**: Yes), CPU**11** turns off the FB indicator **117**, as in the first embodiment desccribed with respect to FIG. **4** step (S**10**), and executes a level control termination processing (S**11**). In cases other than the two cases described above, when it is determined that the application of the feedback effect continues (S**3**: No), and the FB indicator **117** is lit on (S**4**), processing proceeds to S**6**.

In the second embodiment of FIG. **6**, the determination at step S**3** requires different processing than the first embodiment of FIG. **3**, but other of the operations of the first embodiment of FIG. **4** are performed for the second embodiment of FIG. **6**

FIG. **6** is a functional block diagram showing detailed functions of the FB effect adding device **241** in a second embodiment. The FB effect adding device **241** is a function that replaces the FB effect adding device **141** of the first embodiment of FIG. **3**. The FB effect adding device **241** is equipped with a multiplier **281** in place of the fade part **176** in the FB effect adding device **141** of FIG. **3**.

A signal output from the multiplier **275** is input to the multiplier **281**, and the value corresponding to the amount of operation of FBLC (**15***b*) is input as a coefficient. Therefore, the multiplier **281** multiplies the level of the signal output from the multiplier **275** by the coefficient corresponding to the amount of operation of FBLC (**15***b*), thereby adjusting the level of the output signal from the multiplier **275**, and outputs the same to the adder **277**.

In the second embodiment, the level of the feedback effect can be freely changed if necessary in proportion to the amount of the operation of FBLC (**15***b*). Therefore, the feedback effect can be arbitrarily operated at any time during performance regardless of own standing position.

It is noted that fade-in or fade-out of the FB effect processed sound is done by the fade part **176** at the time of on/off switching in the first embodiment of FIG. **3**. In the second embodiment of FIG. **6**, to turn off the effect, FBLC (**15***b*) is set to zero, and therefore, when on/off of the effect is switched, fade in/fade out will be done manually, and the fade part that automatically performs fading is unnecessary.

Next, a third embodiment of the embodiments is described with reference to FIG. **7**. In the first embodiment described above, the level of the output signal from BPF **173** is detected by the level detection part **174**, and it is assumed a configuration in which the level of the output signal from the multiplier **175** is controlled according to the detected level. In contrast, in the third embodiment, the level of the output signal from the multiplier **375** is controlled according to the level of the signal before it is input to BPF **373**. In the second embodiment, the same signs are assigned to the same parts as those of the first embodiment described above, and description thereof is omitted.

FIG. **7** is a functional block diagram showing detailed functions of an FB effect adding device **341** in the third embodiment. The FB effect adding device **341** is a function that replaces the FB effect adding device **141** of the first embodiment. As shown in FIG. **7**, the digital signal input to the FB effect adding device **341** is supplied to the BPF **373**, the adder **377**, and the level detection part **374**. The level detection part **374** detects the level of the input signal, and supplies level information indicative of the detected level to the FB control part **372**. When the feedback effect is turned on by the FB switch **15***a*, the FB control part **372** sets a coefficient to be supplied to the multiplier **375** based on the level information supplied from the level detection part **374**. The FB control part **372** sets an output value, based on the coefficient set and the amount of operation of FBLC (**15***b*), like the first embodiment, and supplies the set output value to the multiplier **375**.

In the third embodiment, the level of the output signal from BPF **373** is controlled according to the level of the signal before being input to BPF **373**. Therefore, in the third embodiment, the level of the signal with a specific frequency characteristic that passed BPF **373** is controlled, such that the electronic guitar **100** with the built-in FB effect adding device **341** can stably carry out the feedback performance, similar to the first embodiment. Level control of the signal output from BPF **373** depends on the amount of operation of FBLC (**15***b*), like the first embodiment. Therefore, by the electronic guitar **100** with the built-in FB effect adding device **341**, the level of feedback effect can be arbitrarily adjusted regardless of the performer's standing position, similar to the first embodiment.

Moreover, as for the FB effect adding device **341** of the third embodiment, the multiplier **375** supplies the output signal to the fade part **376** and the pitch detection part **371**, as shown in FIG. **7**. Therefore, the pitch detection part **371** detects the pitch of the signal that passed BPF **373**, and sets parameters corresponding to the detected pitch to BPF **373**.

Because the signal with the frequency characteristic corresponding to the pitch of the input string signal can be output from BPF **373** even when the pitch detection by the pitch detection part **371** is performed on the signal that passed BPF **373**, as in the third embodiment, the feedback performance can be stably performed, similar to the first embodiment. In the third embodiment, when the feedback effect is turned off (when the pitch detection is being performed), it is preferable that BPF **373** is may be a filter with a flat characteristic (its setting is to be reset). In the example shown in FIG. **7**, the pitch of the output signal from the multiplier **375** is detected by the pitch detection part **371**. However, the output signal that has been output from BPF **373**, and before it is input to the multiplier **375** may be detected by the pitch detection part **71**.

Next, a fourth embodiment of the invention will be described with reference to FIG. **8**. In the first embodiment described above, the function to control the timbre and the volume of the tone signal (EQ/Vol **142**) is achieved by the cooperative processing done by CPU **11** and DSP **14**. However, in accordance with the fourth embodiment, the timbre and the volume of the tone signal are controlled by an analog circuit (analog circuit **401**). In other words, in the fourth embodiment, an example in which the FB effect adding device is built into an electronic guitar of the conventional type is illustrated. Note that, in the fourth embodiment, the same signs are assigned to the same parts as those of the first through third embodiments described above, and description thereof is omitted.

FIG. **8** (*a*) is a first example of an electronic guitar of the fourth embodiment. In the first example, the string signal (analog signal) output from each of the pickups **107**, **108** and **109** is supplied to analog circuit **401**. The analog circuit **401** controls the timbre and the volume of the input string signal according to inputs from other operators **16** (the tone **16***a* and the volume **16***b*), and the processed signal is supplied to ADC **17**. The ADC**17** converts the analog signal whose tone and volume are controlled into a digital signal, and supplies the signal to the FB effect adding device **141**.

According to the input from the FB operator **15** (FB switch **15***a* and FBLC **15***b*), the FB effect adding device **141** controls application of the feedback effect, similar to the first embodiment. The FB effect adding device **141** supplies the processed signal to DAC **18**, and DAC **18** converts the processed digital signal into an analog signal, and outputs the signal from the jack **21**.

FIG. **8** (*b*) is a second example of an electronic guitar of the fourth embodiment. In the second example, after the application of the feedback effect has been controlled by the FB effect adding device **141**, the timbre and the volume are controlled by the analog circuit **401**.

Specifically, as shown in FIG. **8** (*b*), the string signal (analog signal) output from each of the pickups **107**, **108** and **109** is supplied to ADC **17**, converted into a digital signal in ADC **17**, and then supplied to the FB effect adding device **141**.

The FB effect adding device **141** controls application of the feedback effect according to the input from the FB operator **15** (FB switch **15***a* and FBLC **15***b*), like the first embodiment. The FB effect adding device **141** supplies the signal after processing to DAC **18**, DAC **18** converts the digital signal after processing into an analog signal, and supplies the signal to the analog circuit **401**.

The timbre and the volume of the input string signal are controlled in the analog circuit **401** according to the input from the other operator **16** (the tone **16***a* and the volume **16***b*), and the signal after processing is output from the jack **21**.

As described above, by incorporating the FB effect adding device **141** in an electronic guitar of the conventional type that controls the timbre and the volume of tone signals with the analog circuit **401**, the electronic guitar of the conventional type can achieve effects similar to those of the first embodiment. Note that, though the FB effect adding device **141** is illustrated as representative in FIGS. **8**(*a*) and **8** (*b*), the FB effect adding device **241** or the FB effect adding device **341** may be used instead of the FB effect adding device **141**.

In the above-described embodiment, the pickups **107**, **108** and **109** are each an example of the string vibration detection device. The FB operator **15** is an example of the feedback operator. The FB effect giving devices **141**, **241** and **341** are each an example of the feedback control device. The jack **21** is an example of the output device.

Though the present invention has been described based on the embodiments, the present invention is not limited in any way to the embodiments described above, and it can be readily presumed that various modifications and improvements can be made within the scope not departing from the subject matter of the invention.

For example, in the above-described embodiment, as the pickup **107**, **108** and **109**, an electromagnetic pickup that detects the vibration of the six strings **105** together without distinguishing between them, and outputs a string signal has been exemplified. However, it is possible to employ a pickup that detects the vibration of each of the six strings **105** and outputs the musical tone signal of each of the strings individually. It is also possible to pick up the string vibration by optical sensors or ultrasonic sensors. Moreover, a piezoelectric device (piezoelectric element) that may be installed on the bridge, the body or the neck to pick up the vibration may be used, instead of the electromagnetic pickup that electromagnetically picks up the string vibration. Moreover, though three pickups are exemplified in the above-described embodiment, any number of pickups may be provided, and plural different kinds of pickups may be used in combination. It is obvious that the pickup selector **10** is unnecessary if only one pickup is used or all pickup outputs are always detected.

In the above-described embodiment, as the FB switch **15** that switches on and off the feedback effect, the touch switch **115**, the tremolo arm **116**, and the operation knob **114** of the electrostatic type (electrostatic capacity type) are exemplified. However, various types of sensors, such as, pressure sensitive sensors, proximity sensors and like may be used.

Moreover, various types of switches that can switch two states, i.e., on and off states, such as, a push-button type switch, a toggle switch, etc. may be used as the FB switch **15***a*. Moreover, the touch switch **115** may be configured with a proximity switch, such that the feedback effect may be turned on by approaching the hand to the touch switch **115**.

In the above-described embodiment, though the operation knob **114** is composed of an electroconductive material, a part of the operation knob **114** may be made to be electroconductive, and the electroconductive part may be used as the detection part of the FB switch **15***a*.

As a result, when the performer operates the operation knob **114** while touching the electroconductive part, the level of the feedback effect can be adjusted while performing the feedback performance. On the other hand, when the performer operates the operation knob **114** without touching the electroconductive part, the level of the feedback effect can be adjusted regardless of whether or not the feedback performance is carried out.

In the above-described embodiment, a rotary potentiometer with the operation knob **114** of a rotary type as the operation part and a variable resistor (not shown in the figure) as the detection part is exemplified as FBLC (**15***b*). However, a linear potentiometer having a slider as the operation part may be used as FBLC (**15***b*). Moreover, a sensor that can obtain a value corresponding to the operation, such as, a pressure-sensitive sensor, a proximity sensor or the like may be used as FBLC (**15***b*).

In the above-described embodiment, a variable value corresponding to the amount of operation of FBLC (**15***b*) is used to decide the coefficient to be input to the multiplier **75**. However, it may be configured to use predetermined values stored in advance in ROM **12**, etc.

In the second embodiment described above, though the value corresponding to the amount of operation of FBLC (**15***b*) is supplied to the FB control part **272** and the multiplier **281**. However, an operator that supplies the coefficient to the multiplier **281** may be provided independently of FBLC (**15***b*). In other words, the mixing ratio between the level of the signal to which the feedback effect is added (the level of the signal output from the multiplier **275**) and the level of the original string signal may be adjusted by an operator that is provided independently from FBLC (**15***b*).

In the above-described embodiments, one band-pass filter (BPF **173**, **273**, **373**) is installed to each of the FB effect adding devices **141**, **241** and **341**. However, a composition in which two band-pass filters or more are installed may be used. When two or more band-pass filters are installed, it is possible to use a composition that changes the number of the band-pass filters to be used depending on the range of the string signal.

In the above-described embodiment, one band-pass filter (BPF **173**, **273**, **373**) is installed in each of the FB effect adding devices **141**, **241** and **341**. However, BPF **173**, **373**, **373** may be replaced with the one in which a high-pass filter and a low-pass filter are connected in series.

In the above-described embodiments, the input signal is filtered by the band-pass filter (BPF **173**, **373**, **373**). However, a variety of filters may be used if the filters can pass only a specific band.

In the above-described embodiments, the filter characteristic of the band-pass filter (BPF **173**, **373**, **373**) is changed independently for each of the three frequency bands, i.e., the bass range, the midrange, and the treble range. However, each of the band regions may be further divided, and the filter characteristic of the band-pass filter (BPF **173**, **273**, **373**) may be changed independently for each of the further divided bands.

In the above-described embodiments, the level of the output signal from the multipliers **175**, **275**, **375** (that is, the level of the output signal from BPF **173**, **273**, **373**) is controlled by FB control part **172**, **272**, **373** according to the level detected by the level detection part **174**, **274 37**. Instead of such a configuration, the level of the signal before being input to BPF **173**, **273**, **373** may be controlled by the FB control part **172**, **272**, **373** according to the level detected by the level detection part **174**, **274**, **374**. Moreover, the FB control section **172**, **272**, **372** may be configured to control the level of the output signal from BPF **173**, **273**, **373** by adjusting the gate of BPF **173**, **273**, **373**.

In the first and third embodiments described above, when the feedback effect are switched on and off by the FB switch **15***a*, the output signal from BPF **173**, **373** is faded in or faded out in the fade part **176**, **376**. However, it is possible to cross-fade the digital signal input to the FB effect adding device **141**, **373** and the output signal from BPF **173**, **373**.

In the above-described embodiment, the electronic guitar **100** is exemplified as a stringed instrument with the built-in FB effect adding device **141**, **241**, or **341**. However, the invention is also applicable to other stringed instruments, such as, an electronic base guitar and the like.

In the above-described embodiment, though the control device including CPU **11**, DSP **14**, etc. is built into the body **102**, it is possible to use a composition in which the controller including CPU **11**, DSP **14**, etc. is attached to the surface of the body **102**. By providing the composition in which the controller including CPU **11**, DSP **14**, etc. is installed on the surface of the body **102**, the FB effect adding device **141**, **241** or **341** (CPU **11**, DSP**14**) is also installed on the surface of the body **102**.

In the above-described embodiment, a composition in which the signal processed in DSP **14** is output from the jack **21**, after it has been converted into an analog signal by DAC **18**, was illustrated. However, it may be output from the electronic guitar **100** digitally in a digital audio format, such as, SPDI/F, USB Audio, or the like without converting it into an analog signal through DAC **18**, and may be connected with an amplifier, a mixer, a PC (personal computer), etc. with a digital input.

What is claimed is:

1. An electronic stringed instrument comprising:

a pickup that detects vibration of a string;

a feedback operator used to select a level of feedback effect;

a feedback control device comprising:

a filter device that passes a tone signal based on the vibration of the string detected by the pickup;

a pitch detection device that detects the pitch of the tone signal based on the vibration of the string detected by the pickup; and

a setting device that sets a parameter of the filter device according to the pitch detected by the pitch detection device that controls the filter device to add a feedback effect to the tone signal based on the vibration of the string detected by the string vibration detection device and based on the selected level of feedback effect from the feedback operator; and

an output device that outputs the tone signal to which the feedback effect is added by the feedback control device.

2. The electronic stringed instrument of claim **1**, wherein the feedback operator comprises a pressure-sensitive sensor that changes the level of the feedback effect according to a pressurizing condition.

3. The electronic stringed instrument of claim **1**, wherein the feedback operator is further used to cause a switching on and off of the feedback effect.

4. The electronic stringed instrument of claim **3**, wherein the feedback operator comprises a sensor, and causes the switching on and off the feedback effect based on detection by the sensor.

5. The electronic stringed instrument of claim **4**, wherein the sensor comprises an electrostatic capacity type touch sensor.

6. The electronic stringed instrument of claim **4**, wherein the sensor comprises a pressure-sensitive sensor.

7. The electronic stringed instrument of claim **3**, wherein the feedback operator comprises a feedback switch, and causes the switching on and off the feedback effect based on the state of the feedback switch.

8. The electronic stringed instrument of claim **7**, further comprising:

a setting operator capable of changing a set value; and

an operation part for operating the setting operator and having an electro conductive part, wherein the feedback switch is a switch that includes the operation part and turns on the feedback effect when the electro conductive part of the operation part is contacted by a user of the electronic stringed instrument.

9. The electronic stringed instrument of claim **1**, wherein the setting device sets, to the filter device, a parameter corresponding to a frequency band to which the pitch detected by the pitch detection device belongs.

10. The electronic stringed instrument of claim **1**, wherein the filter device comprises a band pass filter, and the parameter set by the setting device comprises a center frequency, a Q value and a gain of the filter device.

11. The electronic stringed instrument of claim **1**, wherein the feedback control device further includes:

a level detection device detecting a level of the tone signal from the filter device; and

a level control device adjusts a level of tone signal output from the output device based on the level detected by the level detection device.

12. The electronic stringed instrument of claim **11**, wherein the level control device raises the level of the tone signal output from the filter device when the level detected by the level detection device is below a predetermined level, and maintains the level of the tone signal output from the filter device when the predetermined level is exceeded.

13. An electronic stringed instrument comprising:

a pickup that detects vibration of a string;

a feedback switch used to select a level of feedback effect and to cause a switching on and off of the feedback effect based on a state of the feedback switch, and including a tremolo arm including an electro conductive part to cause a turning on of the feedback effect when the electro conductive part of the tremolo arm is touched;

a feedback control device that controls to add a feedback effect to a tone signal based on the vibration of the string detected by the string vibration detection device and based on the selected level of feedback effect from a feedback operator; and

an output device that outputs the tone signal to which the feedback effect is added by the feedback control device.

14. An effect device comprising:

an input device to which a tone signal based on vibration of strings of a stringed instrument is input;

a filter device that passes the tone signal from the input device;

a pitch detection device that detects a pitch of the tone signal from the filter device and/or a pitch of the tone signal to be input to the filter device;

an output device that outputs the tone signal output from the filter device;

a feedback switch that is capable of switching the feedback effect on and off; and

a setting device that sets a parameter of the filter device corresponding to the pitch detected by the pitch detection device when the feedback switch is turned on, and that resets a parameter of the filter device corresponding to the pitch detected by the pitch detection device if the difference of the pitches between the pitch detected by the pitch detection device and the pitch that was used to determine the current parameter of the filter device is greater than a predetermined value.

15. The effect device of claim **14**, wherein the input device comprises a touch detection part having an electrostatic capacity type touch sensor.

16. The effect device of claim **14**, wherein the input device comprises a touch detection part is a pressure-sensitive sensor.

17. The effect device of claim **14**, wherein the filter device comprises digital signal processing.

18. An effect device comprising:

an input device receiving a tone signal based on vibration of strings of a stringed instrument;

a filter device that passes the tone signal input from the input device;

a pitch detection device that detects a pitch of the tone signal input from the filter device and/or a pitch of the tone signal to be input to the filter device;

an output device that outputs the tone signal output from the filter device;

a feedback switch that is capable of switching on and off of the feedback effect;

a setting device that sets a parameter of the filter device corresponding to the pitch detected by the pitch detection device when the feedback switch is turned on, and that re-sets a parameter of the filter device corresponding to the pitch detected by the pitch detection device if the difference of the pitches between the pitch detected by the pitch detection device and the pitch that was used to determine the current parameter of the filter device is greater than a predetermined value;

a level detection device that detects a level of the tone signal output from the filter device and/or a level of the tone signal to be input in the filter device; and

a level control device that controls the level of the tone signal output outside from the output device to have a level corresponding to the level detected by the level detection device.

19. The effect device of claim **18**, wherein the input device comprises a touch detection part having an electrostatic capacity type touch sensor.

20. The effect device of claim **18**, wherein the input device comprises a touch detection part having a pressure-sensitive sensor.

21. The effect device of claim **18**, wherein the filter device comprises digital signal processing.

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